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Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS: T. MATANO ET AL EXAMINER: ERIC K. WONG  
SERIAL NO.: 09/914,116 GROUP: 2874  
FILED: AUGUST 23, 2001  
FOR: TEMPERATURE COMPENSATION MEMBER AND OPTICAL  
COMMUNICATION DEVICE USING THE SAME

**RESPONSE**

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

This is in response to the Office letter of April 26,  
2004.

A proposed drawing correction labeling Figs. 1 and 2 as --  
Prior Art-- is attached hereto.

The rejection of claims 1 and 5-10 under 35 U.S.C.  
102(b) as being anticipated by Fleming et al, cited, is  
respectfully traversed. As the following comments will show,  
the claimed subject matter is neither anticipated by, nor  
obvious from, the cited patent.

As disclosed in col. 4, line 26, of the patent, the sintered body of zirconium tungstate exhibits a thermal expansion coefficient of  $-12.4 \times 10^{-6}/^{\circ}\text{C}$ . This material cannot be used as a thermal compensating member because the thermal expansion coefficient is excessively large in a negative direction. The thermal expansion coefficient is adjusted to an appropriate level for a temperature compensating member by mixing an appropriate amount of a material having a thermal expansion coefficient around zero or a positive thermal expansion coefficient to the above-mentioned compound with a negative thermal expansion coefficient.

The attached article by Evans et al, Chem. Mater. 1996, 8, 2809-2823, states that the crystal of zirconium tungstate has a cubic crystal structure. In other words, it does not exhibit anisotropy in thermal expansion coefficient. Rather, it has a large negative thermal expansion coefficient in all crystal axes. Therefore, if a material having a thermal expansion coefficient around zero or a positive thermal expansion coefficient is mixed with zirconium tungstate and the mixture is sintered, a large stress is produced at an interface because the difference in the thermal expansion coefficients therebetween is large. Therefore, cracks are easily caused to occur at the interface and the mechanical strength is degraded in time. In addition, the thermal expansion coefficient tends to be easily

changed. Accordingly, this material is difficult to use as a temperature compensating member. This observation is also supported by the disclosure on page 4, lines 19-25.

On the other hand, the crystal used in the claimed sintered body and which exhibits anisotropy in thermal expansion coefficient is a crystal having a negative coefficient of thermal expansion in at least one crystal axis direction and a positive thermal expansion coefficient in other axis directions, as pointed out on page 9, lines 1-4, of the specification. If the coefficient of the crystal as a whole is large in the negative direction, it can be adjusted to an appropriate level for a temperature compensating member by admixing an appropriate amount of a material having a thermal expansion coefficient around zero or a positive thermal expansion coefficient, and sintering the mixture. The thermal expansion coefficient in at least one crystal axis direction has a positive value in the crystal used in the claimed temperature compensating member. Therefore, the difference in thermal expansion coefficient from the material having a thermal expansion coefficient around zero or a positive thermal expansion coefficient is not so great. Even if the temperature change is repeated, no large stress is produced at a grain boundary, and the mechanical strength is hardly degraded. The thermal expansion coefficient is not changed with time.

According to the disclosure on page 8, lines 18-27, the crystal particles are preferably rearranged during the heat treatment to increase the filling density and to increase contact areas between the particles. This improves the mechanical strength.

In view of the above, claims 1 and 6-10 are believed clearly to be patentable over Fleming et al. As to claim 5, it recites the thermal expansion coefficient within the defined range while the patent (see claim 4) deals with the operating temperature range. Thus, the patent disclosure is not pertinent to this claim, which accordingly is respectfully submitted to be patentable.

The rejection of claims 2-4 under 35 U.S.C. 103(a) as being unpatentable over Fleming et al is also respectfully traversed. Apparently, the Examiner understands that a crystal powder, such as silicate or phosphate, is added in order to adjust the thermal expansion coefficient, as alumina or silica does. However, the specific crystal powder set forth in these claims is a crystal exhibiting anisotropy in thermal expansion coefficient and functions as a component moving the thermal expansion coefficient in a negative direction. Therefore, the claimed subject matter is not obvious from Fleming et al, and claims 2 and 3 are patentable thereover.

As to claim 4, the advantage of the claimed particle size has been noted on page 8, last two lines. The increased contact area between the powder particles increaszes the mechanical strength. Nothing like this being suggested by the prior art, this claim is also believed to be patentable on its own merit.

A sincere effort having been made to overcome all grounds of rejection, favorable reconsideration and allowance of claims 1-10 are respectfully solicited.

Respectfully submitted,

TAKAHIRO MATANO ET AL

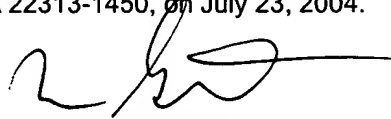


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Enclosure: 1 sheet of drawings  
Article by Evans et al

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: MAIL STOP Amendment, COMMISSIONER FOR PATENTS, P.O. Box 1450, Alexandria, VA 22313-1450, on July 23, 2004.



Maria Guastella

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